



Deutscher Wetterdienst



## AutoWARN

The Automated  
Weather Warning System in NinJo

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## Content

- ◆ Introduction and Overview
- ◆ Automatic Warning Process
- ◆ Radar Products
- ◆ Statistical Products and COSMO-DE Interpretation

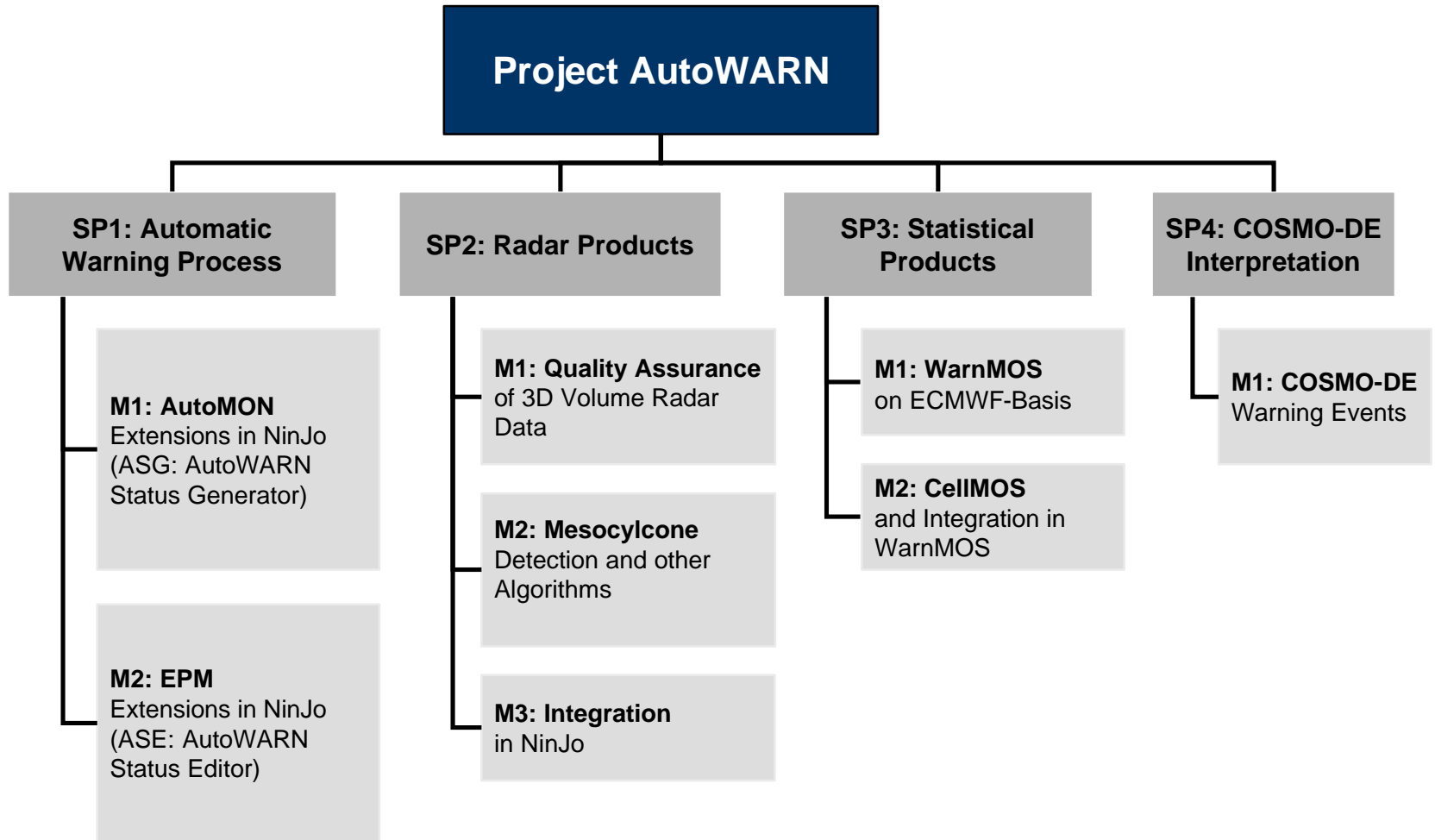
## AutoWARN Project Goals

**AutoWARN is part of the DWD strategy 2006-2015 (Headwords: *Centralization* and *Automation*).**

### Project goals:

- 1. Improvement of methods and products serving as a basis for the prediction of hazardous weather events**
- 2. Integration of products in an automated warning process with manual monitoring and decision capabilities by the forecaster**

## Project Structure

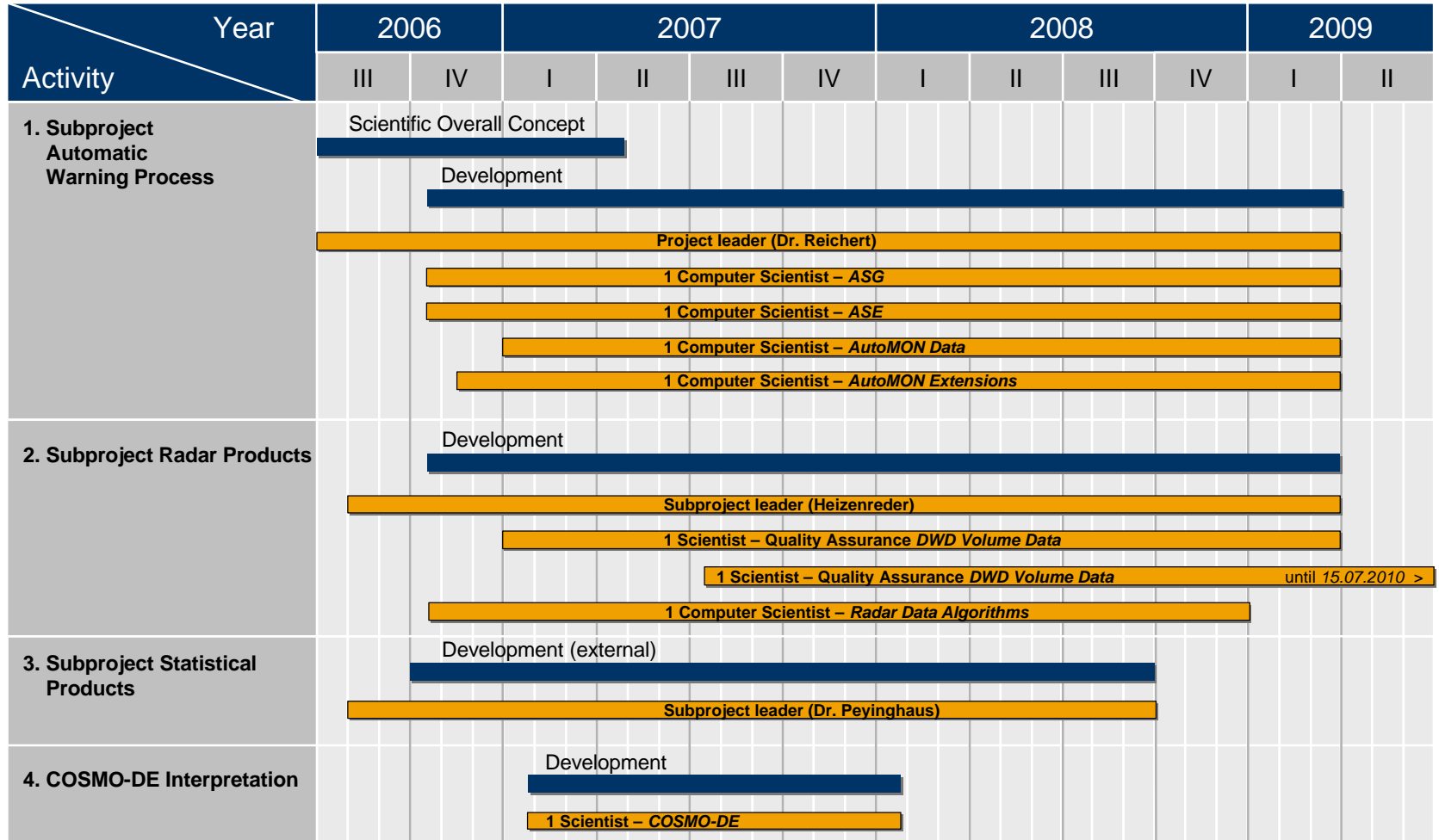


# Project AutoWARN



Time Planning

Resources



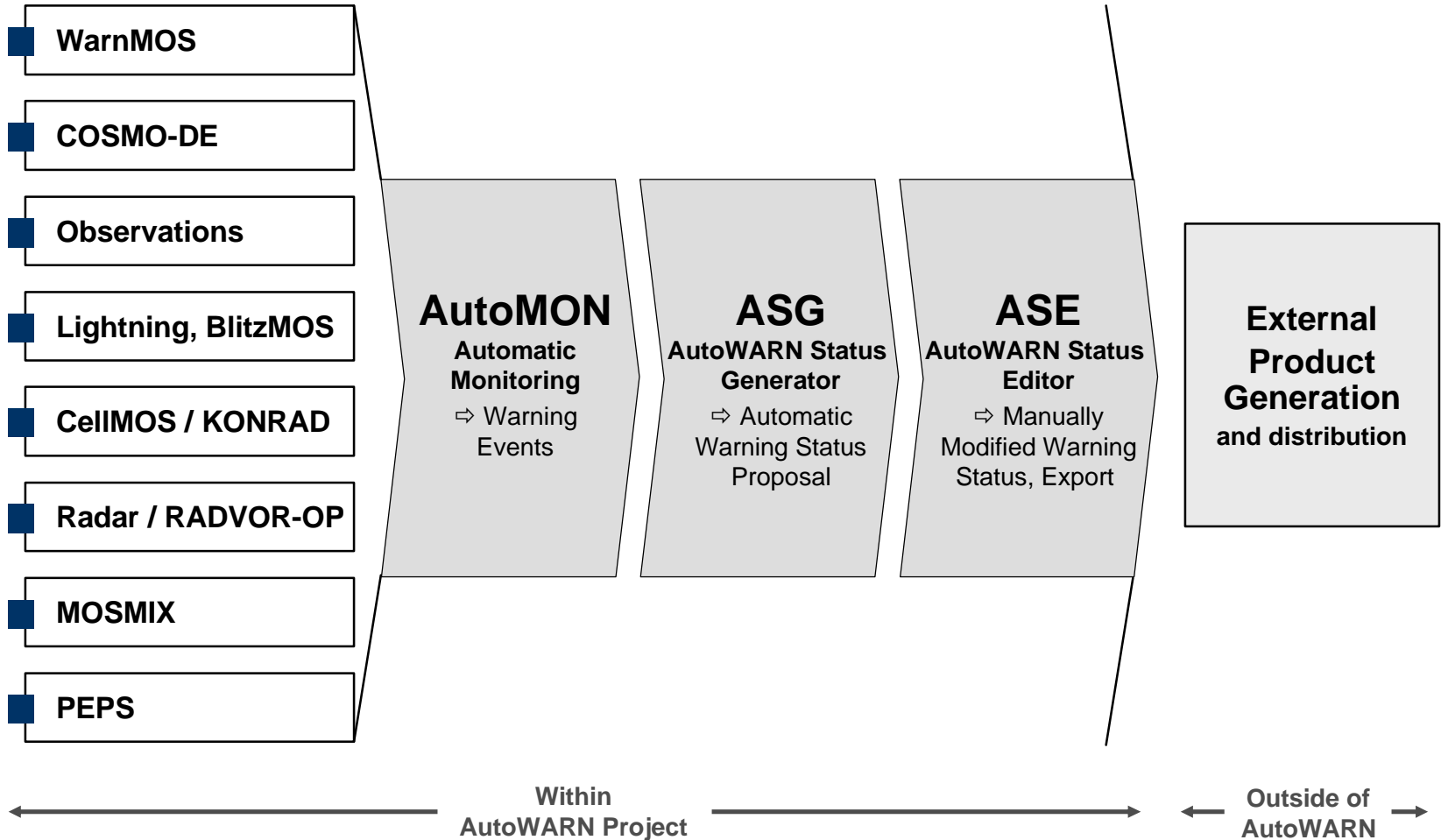
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## Automatic Warning Process: Goals

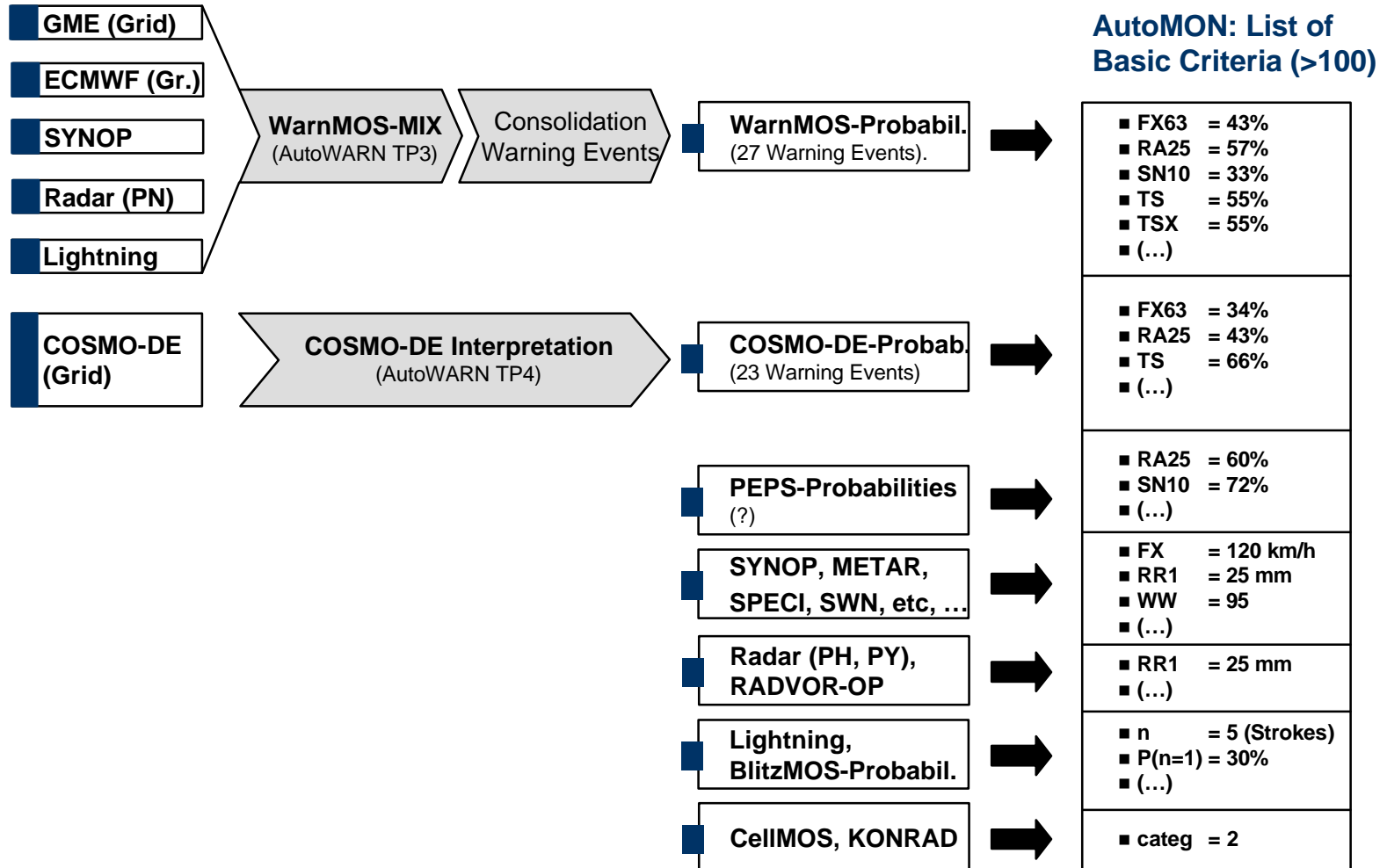
- **Exploitation and combination of various data sources**
  - Arbitrary data combinations (Probability information (WarnMOS), Nowcasting, Observations, Model runs, etc.)
  - Definition and monitoring of threshold values
  
- **Generation of a forecast-time dependant automatic warning status**
  - Ensures that required warnings cannot be overlooked
  - Supports the warning service
  
- **Permanent updates of the warning status**
  
- **Permanent manual control by the forecaster**
  - manual modification if necessary
  
- **Export of generated warning status to external system (outside of project AutoWARN)**
  - External generation of text and graphical products considering client demands

## Automatic Warning Process: Overview





## Generation of a Warning Status Proposal 1/3



## Generation of a Warning Status Proposal 2/3

**AutoMON: List of Basic Criteria (>100)**

**AutoMON: Spatiotemp. Combination**

**AutoMON: Combined Warning Criteria**

**ASG: Spatiotemporal Homogenization**

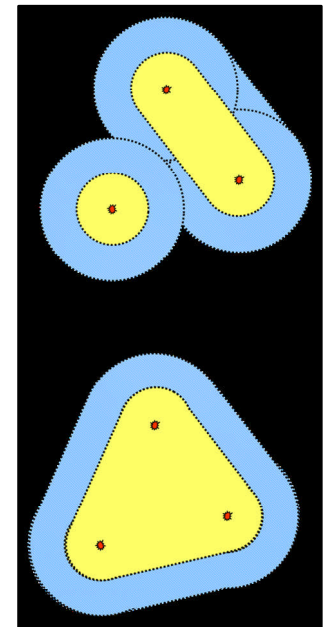
<ul style="list-style-type: none"> <li>■ FX63 = 43%</li> <li>■ RA25 = 57%</li> <li>■ SN10 = 33%</li> <li>■ TS = 55%</li> <li>■ TSX = 55%</li> <li>■ (...)</li> </ul>
<ul style="list-style-type: none"> <li>■ FX63 = 34%</li> <li>■ RA25 = 43%</li> <li>■ TS = 66%</li> <li>■ (...)</li> </ul>
<ul style="list-style-type: none"> <li>■ RA25 = 60%</li> <li>■ SN10 = 72%</li> <li>■ (...)</li> </ul>
<ul style="list-style-type: none"> <li>■ FX = 120 km/h</li> <li>■ RR1 = 25 mm</li> <li>■ WW = 95</li> <li>■ (...)</li> </ul>
<ul style="list-style-type: none"> <li>■ RR1 = 25 mm</li> <li>■ (...)</li> </ul>
<ul style="list-style-type: none"> <li>■ n = 5 (Strokes)</li> <li>■ P(n=1) = 30%</li> <li>■ (...)</li> </ul>
<ul style="list-style-type: none"> <li>■ categ = 2</li> </ul>

OR

OR

AND

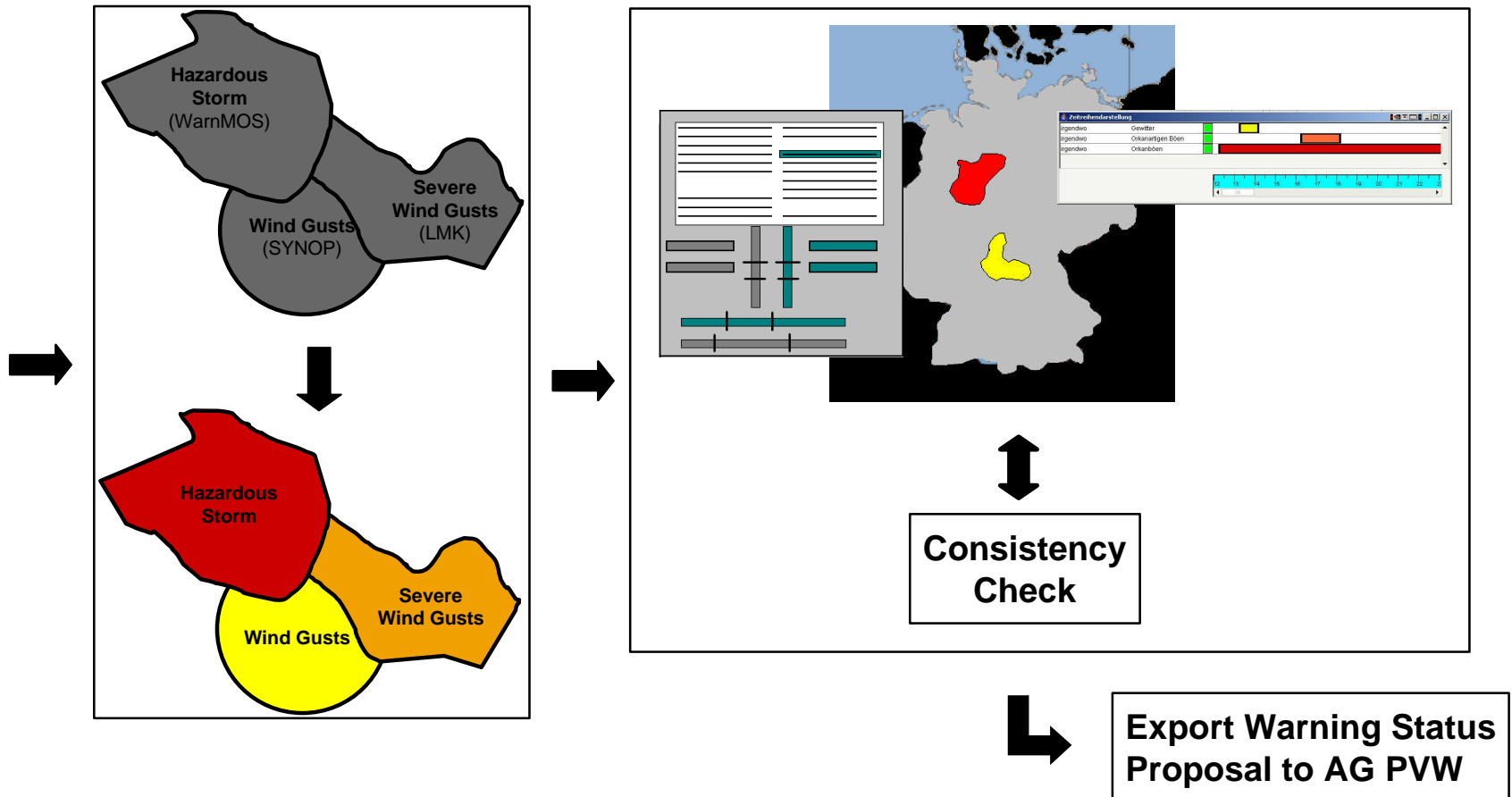
- Wind Gusts
- Hazardous Storm
- Heavy Rain
- Continuous Heavy Rain
- Thunderstorm with Heavy rain and Hail
- (...)



## Generation of a Warning Status Proposal 3/3

**ASG:**  
Force Consistency

**ASE:** Manual Modification of Warning Status Units  
with permanent consistency check

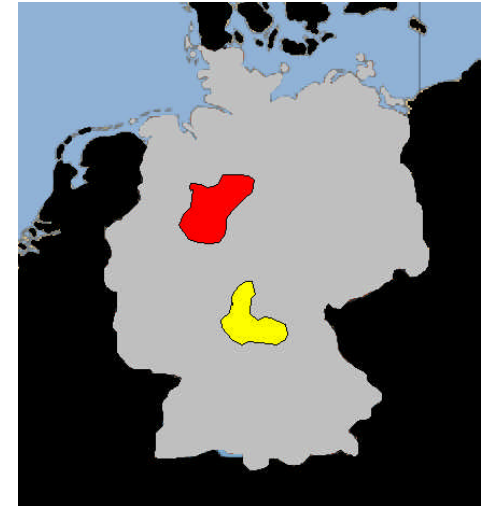


## Products of the Semi-Automated Warning Process in AutoWARN

### ■ AutoWARN generates

- **categorical warn status data (will be extended to probabilities in a project starting in 2009)**
  - For 27 DWD warning events plus approx. 20 combined warning criteria
  - on a polygon basis (“warning status units” in space and time)
  - vertical categorization to the DWD altitudes (e.g. 0-200m, 400-1000m, 1000-2500m)
  - hourly forecasted 0...72 hours

### AutoWARN warning status (all warning criteria, 0...72 hours)



## What AutoWARN not does

- **AutoWARN does not generate direct warning products for clients**
  - AutoWARN only generates automatic warning status proposals revised by the forecaster, only the following external module (PVW) generates warning products
  
- **AutoWARN cannot create “perfect” warning status proposals for all warning events automatically**
  - an automatic warning status proposal cannot be better than the input products (WarnMOS, COSMO-DE model, etc.)
  - some warning events like fog or locally clear ice need the intervention of the forecaster, who is part of the AutoWARN concept

# Project AutoWARN

## Automatic Warning Process: Component AutoMON in NinJo

**Warning Indicators**  
showing status since last confirmation

Warning Events

Kriterium	Klasse	Station	Parameter, Da...	Wert	Gebiet	Meldungszeit	Eintreffzeit	...
Sichtweite unter 150m	Sichtweite	10453 BROCKEN	VV, synop (fm12)	10.0 m	Wernigerode, Magdeburg, Sachsen-Anhalt	08.11.05 08:00:00	08.11.05 08:00:14	---
Sturmböen	Wind	10015 HELGOLAND	FX, synop (fm12)	68.4 km/h	Pinneberg, Schleswig-Holstein	08.11.05 08:00:00	08.11.05 08:00:14	---
Windböen	Wind	10020 LIST/SYLT	FX, synop (fm12)	54.0 km/h	Nordfriesland, Schleswig-Holstein	08.11.05 08:00:00	08.11.05 08:00:14	---
Sichtweite unter 150m	Sichtweite	10427 K.ASTEN	VV, synop (fm12)	0.0 m	Hochsauerlandkreis, Arnsberg, Nordrhei...	08.11.05 08:00:00	08.11.05 08:00:15	---
Sichtweite unter 150m	Sichtweite	10616 HAHN	VV, synop (fm12)	100.0 m	Rhein-Hunsrück-Kreis, Rheinland - Pfalz	08.11.05 08:00:00	08.11.05 08:00:16	---
Windböen	Wind	10453 BROCKEN	FX, synop (fm12)	57.6 km/h	Wernigerode, Magdeburg, Sachsen-Anhalt	08.11.05 08:00:00	08.11.05 08:00:16	---



## Automatic Warning Process: Component AutoMON in NinJo

**AutoMON Hauptfenster**

Datei Bearbeiten Ansicht Kartenausschnitt Hauptszene Favorit Optionen Hilfe

Ereignisse: 000142

WO WP WR QP QW QS

**Ereignisdichte**

- 100%
- 50%
- 20%
- 10%

**Thema Wettermonitoring**

- WM Beobachtungen
- WM Punktvorhersage
- WM Radar

**Thema Qualitätsmonitoring**

- QM Punktvorhersage
- QM Warnstatus
- QM SynSat

**Klassen**

- Alle
- Blitze
- Gewitter
- Regen
- Schnee
- Test

**Kategorien**

- Alle
- Extreme Ereignis
- Starke Ereignisse
- Markante Ereign
- Einfache Ereignis

**Höhenstufen**

- Alle
- 200
- 200-400
- 400-600
- 600-800
- 800-1000
- 1000-1500

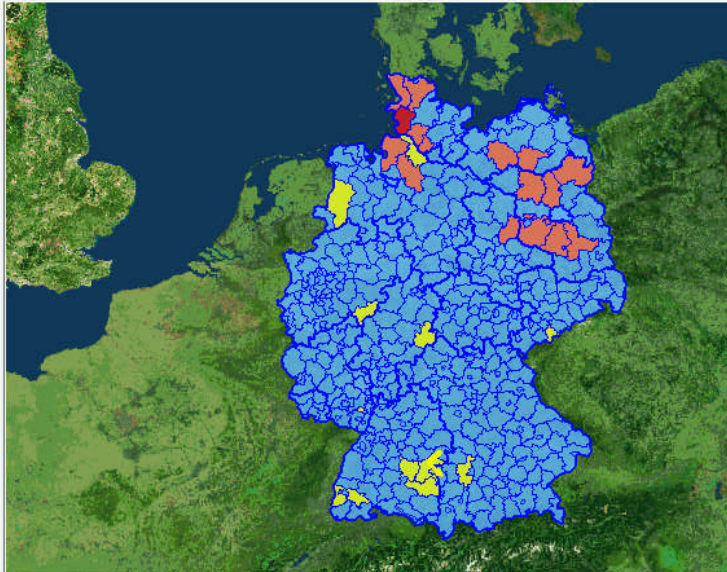
**Datentypen**

- Alle
- WM Beobachtungen
- lightning
- metar
- profile
- station

**Anzeigezeitraum**

- Alle unbestätigten Ereignisse
- Unbestätigte Ereignisse der letzten 60 min.
- Ereignisse im folgenden Zeitraum:

1 h von: 01.09.2005 07:00:00 bis: 01.09.2005 09:00:00



Kriterium	Klasse	Station	Parameter, Datentyp (, Mod...	Wert	Gebiet	Meldungszeit	Eintreffzeit	Bem...
Windböen	Wind	10544 WASSERKUPPE	FX, synop (fm12)	50.4 km/h	Fulda, Kassel, Hessen	01.09.05 01:00:00	01.09.05 01:00:04	---
Blitz	Blitze		INTENSITY, lightning (blids_de)	13000.0 A	Stade, Lüneburg, Niedersachsen	01.09.05 00:49:16	01.09.05 00:50:09	---
Windböen	Wind	10042 OLPENITZ	FX, synop (fm12)	54.0 km/h	Schleswig-Flensburg, Schleswig-Holstein	01.09.05 00:00:00	01.09.05 00:07:18	---
Windböen	Wind	10578 FICHTELBERG	FX, synop (fm12)	61.2 km/h	Annaberg, Chemnitz, Sachsen	01.09.05 00:00:00	01.09.05 00:07:51	---
Windböen	Wind	10578 FICHTELBERG	FX, synop (fm12)	61.2 km/h	Annaberg, Chemnitz, Sachsen	01.09.05 00:00:00	01.09.05 00:00:13	---
Windböen	Wind	10042 OLPENITZ	FX, synop (fm12)	54.0 km/h	Schleswig-Flensburg, Schleswig-Holstein	01.09.05 00:00:00	31.08.05 23:59:59	---

Konfiguration Ereignisse bestätigen

## Automatic Warning Process: AutoMON Extensions

### AutoMON Extensions

- **Include far more input data (areal probabilities from WarnMOS and COSMO-DE model, other probabilistic products, Grid-Data, more Radar-Data, more nowcasting products)**
- **Allow forecast-time dependant configuration of probability data for the generation of warning categories**
- **Allow full spatio-temporal combination of data for warning events**
- **Improve stability and reliability of AutoMON for AutoWARN**





## Requirements

- **Presentation of warning status proposals by ASG (AutoMON Status Generator)**
- **Editing the future warning status based on warning status proposals**

## Result

- **New warning status for subsequent generation of warning products and verification outside of AutoWARN**

## AutoWARN Status Editor (ASE) - GUI Creation and Visualization of Warning Status

The screenshot displays the AutoWARN Status Editor (ASE) interface. The main window shows a map with warning areas (red and yellow) and a data table. The table is titled "sortieren nach: min Höhe" and contains the following data:

Name	Sig	Warngru...	Höhen	Gültigkeitszeitraum (GZ)
			-	
			400 - 600	
			200 - 400	
TODO	TODO	Schwere St...	0 - 200	
			-	
			-	
			1000 - 1500	
			800 - 1000	
			600 - 800	
			400 - 600	
TODO	TODO	Orkanböen	-	

Annotations in the image:

- Creation and visualization of warning areas
- Visualization of elevation and time

## AutoWARN Status Editor (ASE): GUI Warning Status Properties

**Current warning status**

**Selection of warning events**

Name	min	max	Kat	Ereignis	von	bis	mod
TODO	0	3000		Gewitter	Di 09:00	Di 18:00	
TODO	400	1500		Orkanbö...	Di 09:00	Di 18:00	mod
TODO	0	600		Schwere...	Di 20:00	Mi 10:00	mod
TODO	600	2000		Orkanbö...	Di 09:00	Di 10:00	mod
TODO	0	3000	?	?	Di 09:00	Di 10:00	mod

**Elevation interval**

**Warning event type**

**Time interval**

**Warning event type**

**Warning event type**

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## Radar Products: Goals

- **Exploitation of DWD Doppler data, Quality Assurance of 3D-Volume Scans**
  
- **Implementation of Mesocyclone Detection and other Radar Algorithms**
  - Improved algorithms for mesocyclone-, gust- and downburst-detection
  - Tornado-Identification algorithms
  - Exploitation of Doppler data
  - Benefit from Canadian Radar know-how
  
- **Visualization in NinJo**
  
- **Integration of New Products in NinJo and Automatic Warning Process**

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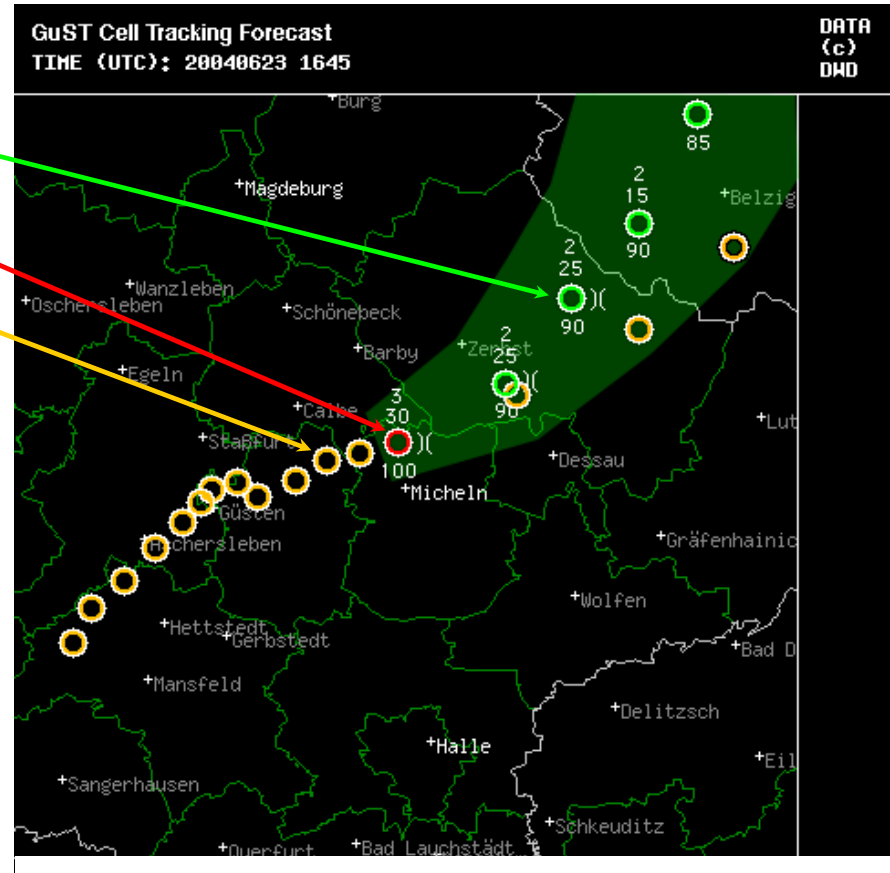
## Statistische Produkte und COSMO-DE Interpretation: Ziele

- **Extension of WarnMOS (Areal Probability Data for Warning Events)**
  - Implementation of WarnMOS-MIX using GME und ECMWF-Model
  
- **Implementation of a new Storm Cell Tracking System CellMOS**
  - Using GME-Model, Radar Composite, Radar-Analysis (KONRAD), Lightning Data
  - Cell Analysis using Radar Data (KONRAD) and optimized statistical tracking approach (MOS-System)
  
- **COSMO-DE Interpretation**
  - Generation of Probability Data for 23 Warning Events from High Resolution Limited-Area Model COSMO-DE (2.8 km resolution)
  
- **Integration of New Products in NinJo and Automatic Warning Process**

## Statistical Products: CellMOS

### ■ Typical CellMOS-Output

- ○: Forecasted Cell Track
- ○: Cell at Issue-Time Point(Analysis)
- ○: Observed Cell Track
- Green Area: Probability > 30% that point in this area is hit by cell





## Summary and Outlook

### ■ **Goals of AutoWARN:**

1. **Improvement of methods and products serving as a basis for the prediction of hazardous weather events**
2. **Integration of products in an automated warning process with manual monitoring and decision capabilities by the forecaster**

### ■ **Pre-operational test phase for AutoWARN is planned for spring 2009**

### ■ **AutoWARN will in follow-up projects as of 2009 be extended:**

1. **Optimize system by improving warning parameters and homogenization process**
2. **Process probability-based information from ensemble model runs, and other MOS-based probability information**